REMARKS

Applicant has extensively amended the claims to reduce the issues and more specifically distinguish over the prior art.

With respect to Claim 1: FIG. 4 of the present invention illustrates how the silicon substrate (16) is provided with power (through the vias (38, 40)) from the silicon layer (14) thereby inducing charge carrier flow (34) to move heat from the hotter SOI center region (22) toward the substrate (16) perimeter.

Within the thermoelectric cooling device (100) of Shiu, et al., heat is absorbed from the IC device (20) at the adjacent metal junctions (38) between p-type thermoelements (46P) and n-type thermoelements (46N). The absorbed heat flows down the thermoelements (to the substrate (10) backside, coupled to a heat sink (70)) in the Z axis only. The thermoelectric cooling device (100) does not provide for electrical charge carrier flow to move from the centermost region of the substrate (10) outward toward the perimeter of the substrate (10) in the X and Y axis. Unlike Shiu, et al., the present invention includes heat absorbing junctions (46) (located near the center of the substrate (16)) and heat rejecting junctions (48) (located near the perimeter of the substrate (16)), both junction types (46, 48) laterally positioned relative each other.

With respect to Claim 2: As seen in the present invention, a SOI structure (10) is illustrated, which includes a buried oxide layer (12) interposed between a silicon layer (14) and a silicon substrate (16). It can also be seen that an active circuitry layer (18) is fabricated from the thin silicon layer (14).

The thermoelectric cooling device (100) of Shiu et al. does not provide for electrical charge carrier flow to move from the centermost region of the substrate (10) outward toward the perimeter of the substrate (10) in the X and Y axis. Additionally, this substrate (10) is not dielectrically

separated from an active silicon layer (20) by a buried oxide layer found in the present invention.

With respect to Claims 4 and 39: Within Shiu et al. (col. 1:14-16), a thermoelectric cooler includes a plurality of thermoelectric cooling elements, which are constructed of materials with dissimilar characteristics. The elements are connected electrically in series and thermally in parallel to provide a plurality of thermoelectric couples. Shiu et al. disclose thermoelements electrically in series with each other to create a thermoelectric cooler (100); however, Shiu et al. do not disclose that the silicon substrate (10) is electrically in series with an electrical load other than itself.

With respect to Claim 6: Figures 3 and 4 of the present invention illustrate charge carrier flow (34) moving (and thereby carrying heat) from the hotter center region (22) on the substrate (16) outward toward the perimeter of the substrate (16). An electrical source is connected the heat absorbing junction (46) (in the substrate center) and heat rejecting junction (48) (by way of conductive vias (38, 40)), both junctions connected to the conductive member (36) (Figure 3). Figures 1 and 2 of Burward-Hoy do not illustrate charge carrier flow between the substrate (235) and the thermoelectric cooling device (201) or even electrical continuity between the two constructs. Within the thermoelectric cooling device (201), heat flows from the second plate (225) to the first plate (215) in the Z axis only. The thermoelectric cooling device (201) does not provide for electrical charge carrier flow to move from the centermost region of the substrate (235) outward toward the perimeter of the substrate in the X and Y axis, and therefore, anticipation is not found.

With respect to Claim 8: Bhatia in Figure 2 (col. 3:47-58) discloses that the IC (42) is electrically connected to the circuit board (40). Within page 15, lines 5-19 of the present invention, it can be seen that both a power source (60) and an electrical load, such as an integrated circuit or

other electronic circuit, are electrically in series with the structure (52) via the electrically conductive members (54, 56) seen in Figure 9c.

Claim 34 has been rewritten to include the limitations of Claim 35 to more specifically distinguish over the prior art.

With respect to Claim 36: Within the thermoelectric cooling device (100) of Shiu, et al., heat is absorbed from the IC device (20) at the adjacent metal junctions (38) between p-type thermoelements (46P) and n-type thermoelements (46N). The absorbed heat flows down the thermoelements (to the substrate (10) backside, coupled to a heat sink (70)) in the Z axis only. Therefore, the thermoelements and insulation layer (34) are both oriented vertically within the substrate (10).

Unlike Shiu, et al., the present invention (FIG. 9 page 14, lines 14-38, page 15, lines 1-4) includes heat absorbing junctions (46) (located near the center of the substrate (16)) and heat rejecting junctions (48) (located near the perimeter of the substrate (16)), both junction types (46, 48) laterally positioned relative each other; therefore, the thermoelements are oriented horizontally within the substrate (16). Electrical isolation, also horizontally oriented, may be provided by a dielectric, such as an oxide or nitride, added to the physical regions between each P and N-type conductivity thermoelement (54, 56).

With respect to Claim 37: Within the thermoelectric cooling device (100) of Shiu, et al., heat is absorbed from the IC device (20) at the adjacent metal junctions (38) between p-type thermoelements (46P) and n-type thermoelements (46N). The absorbed heat flows down the thermoelements (to the substrate (10) backside, coupled to a heat sink (70)) in the Z axis only. Therefore, the thermoelements and the holes (28, 32) (separating each thermoelement) are both oriented vertically within the substrate (10).

Unlike Shiu, et al., the present invention (FIG. 9 page 14, lines 14-38, page 15, lines 1-4) includes heat absorbing junctions (46) (located near the center of the substrate (16))

and heat rejecting junctions (48) (located near the perimeter of the substrate (16)), both junction types (46, 48) laterally positioned relative each other; therefore, the thermoelements are oriented horizontally within the substrate (16). Electrical isolation, also horizontally oriented, may be provided by removing the physical regions between each P and N-type thermoelement (54, 56).

Claim 42 has been rewritten to include the limitations of Claim 45 to more specifically distinguish over the prior art.

With respect to Claim 46: Buist (col. 3:45-48) discloses insulated spacers (46) used to insulate each individual multistage device from each other in a vertically stacked array. Figures 11a through 11c of the present application illustrate dielectric layers (30) insulating each thermoelement couple stage (70, 72, 74) radially, wherein all stages are within one individual multistage device.

With respect to Claim 48: Buist (col.3:40-52) discloses metallizations (28) which form a cold core for a heat spot forming device and the outwardly disposed metallizations (26) form a hot annular ring. Col. 3:30-36 discloses a power source (34) connected to each element contact (38, 42) via leads (36, 40) Therefore, Buist does not disclose thermoelement couples electrically in series with an electrical load other than itself.

With respect to Claim 51: Figures 10a through 10c (page 16, lines 10 through 37 and page 17, lines 1 through 8) of the present invention illustrate a multistage heat dissipating IC device structure comprising a thermoelement couple which is neither connected to a power source or external load. Within each single thermocouple, the two thermoelements (16, 36) are electrically bonded to each other at both the heat absorbing junctions (46) and heat rejecting junctions (48), thereby creating a closed circuit thermoelement couple structure (64). Figure 2a of Buist (col. 3:30-35) discloses a power source (34) connected to the thermocouple via a P-type element contact (38) and a N-type element contact (42). Furthermore, Buist does not disclose the creation of a closed circuit

thermoelement couple structure, which requires an electrical bond between both elements (30, 32) at the heat rejecting junctions and heat absorbing junctions, all within each single thermoelement couple.

The applicant believes Claims 3, 7, 11, and 44 are now allowable resulting from the corrections to the base claims.

Applicant believes the application is now in condition for allowance, and notice thereof is respectfully solicited.

This is to request a two month extension of time. Enclosed is our check for $210.

The Commissioner is authorized to charge any deficiency or credit any over payment to Deposit Account 17-0900.

Respectfully submitted,
JENSEN & PUNTIGAM, P.S.

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Enclosures: Postcard, Appendix with Replacement Drawing Sheets and Annotated Marked-Up Sheets, Check for $210

APPENDIX

I. Replacement Sheet - Figure 5B; Annotated Marked-Up Sheet

II. Replacement Sheet - Figures 12, 13, 14, 15; Annotated Marked-Up Sheet